# Morphologic features of post-resection cortisol trends can predict biochemical remission in Cushing's Disease patients

**Table 1**

| Variable | Cure within 1y | No cure within 1y | p-value |
|---|---|---|---|
| n | 47 | 8 | - |
| % Male sex | 19% | 12% | 1.0 |
| % Macroadenoma | 15% | 38% | 0.2999 |
| % Apoplexy | 4% | 12% | 0.9147 |
| % Piecemeal resection approach | 36% | 25% | 0.8321 |
| % Intraoperative CSF leak | 13% | 25% | 0.5975 |
| % Postoperative complications | 19% | 38% | 0.4847 |
| % Steroid administered | 74% | 38% | 0.0934 |
| Mean age at time of surgery (y) | 44.88 (2.1) | 43.38 (4.86) | 0.7828 |
| Mean length of stay (d) | 3.15 (0.15) | 4.38 (0.73) | 0.1407 |
| Mean maximum tumor diameter (mm) | 8.57 (0.96) | 12.0 (3.54) | 0.3776 |
| Mean tumor volume (mm$^3$) | 512.61 (194.17) | 1759.56 (1248.55) | 0.3551 |
| Mean steroid administration time (h) | 39.94 (2.68) | 54.0 (9.25) | 0.1814 |

**Figure 1**
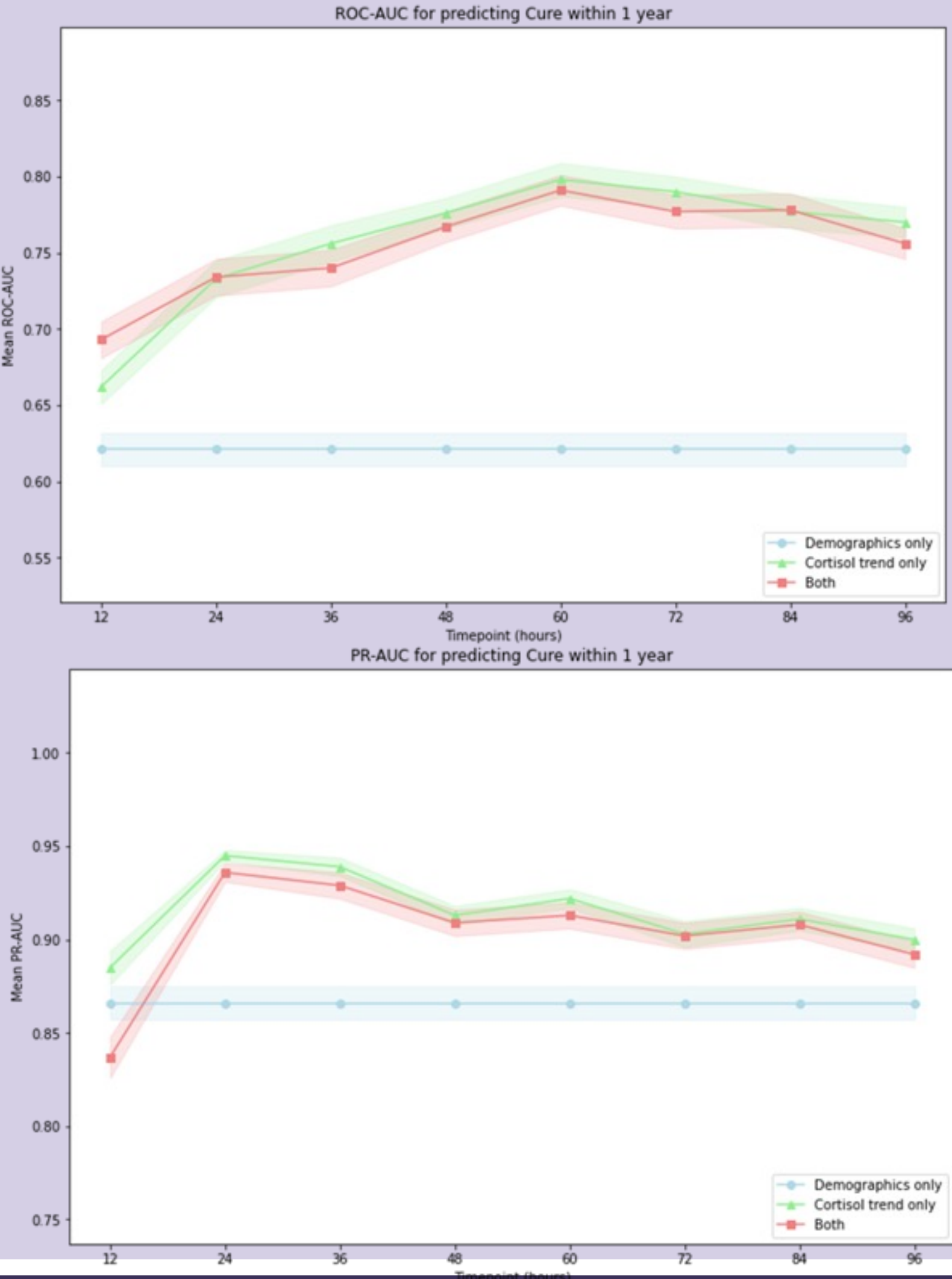


**Figure 2**
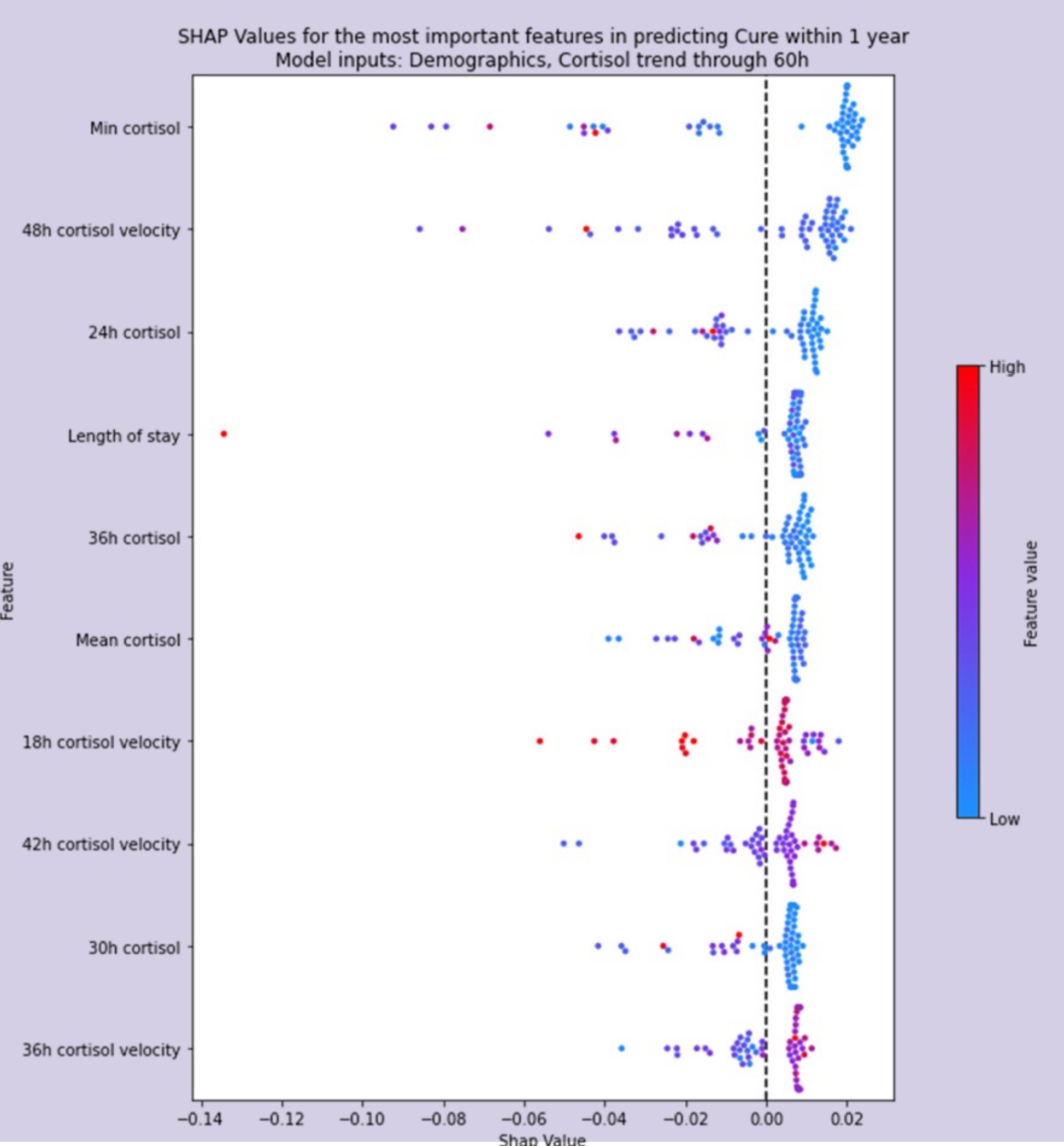


## INTRODUCTION
- Several studies have used machine learning approaches to predict Cushing's Disease biochemical remission after resection.
- However, no studies have examined serially monitored postoperative cortisol trends as input features.

## METHODS
- Patients were selected from transsphenoidal pituitary adenoma resections for patients with Cushing's Disease from a tertiary academic medical center from 2009-2019.
- Predictor variables of interest included demographic features, tumor characteristics, and postoperative cortisol collected at 6-hour intervals for a 96-hour period. The outcome of interest was biochemical remission within 1 year.
- A random forest machine learning model was trained on various feature subsets and time points using 50-fold random cross validation and compared using average AUC-ROC and AUC-PR metrics.
- An optimal model and time point was chosen for variable importance assessment using forward feature selection.

## RESULTS
- Of 55 patients, 47 (85%) achieved cure within 1 year (**Table 1**).
- At all evaluated time points, models that used cortisol data outperformed models that did not use cortisol data in terms of AUC-ROC (p < 0.01).
- There was no significant difference between models that used postoperative cortisol only versus postoperative cortisol in conjunction with demographic and tumor characteristics (**Figure 1**). Optimal performance was at 60 hours with the cortisol-only model achieving an average AUC-ROC of 0.791.
- Analysis of the full-feature model demonstrates that timepoint of cortisol nadir, macroadenoma, length of stay, and centroid were negatively associated with cure status, while 48-hour running slope was positively associated (**Figure 2**).

## CONCLUSIONS
- Postoperative cortisol trajectory is highly predictive of biochemical cure status and should be incorporated into future models and studies

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